THE METAL INDUSTRY

WITH WHICH IS INCORPORATED THE ALUMINUM WORLD.

A TRADE JOURNAL RELATING TO THE NON-FERROUS METALS AND ALLOYS.

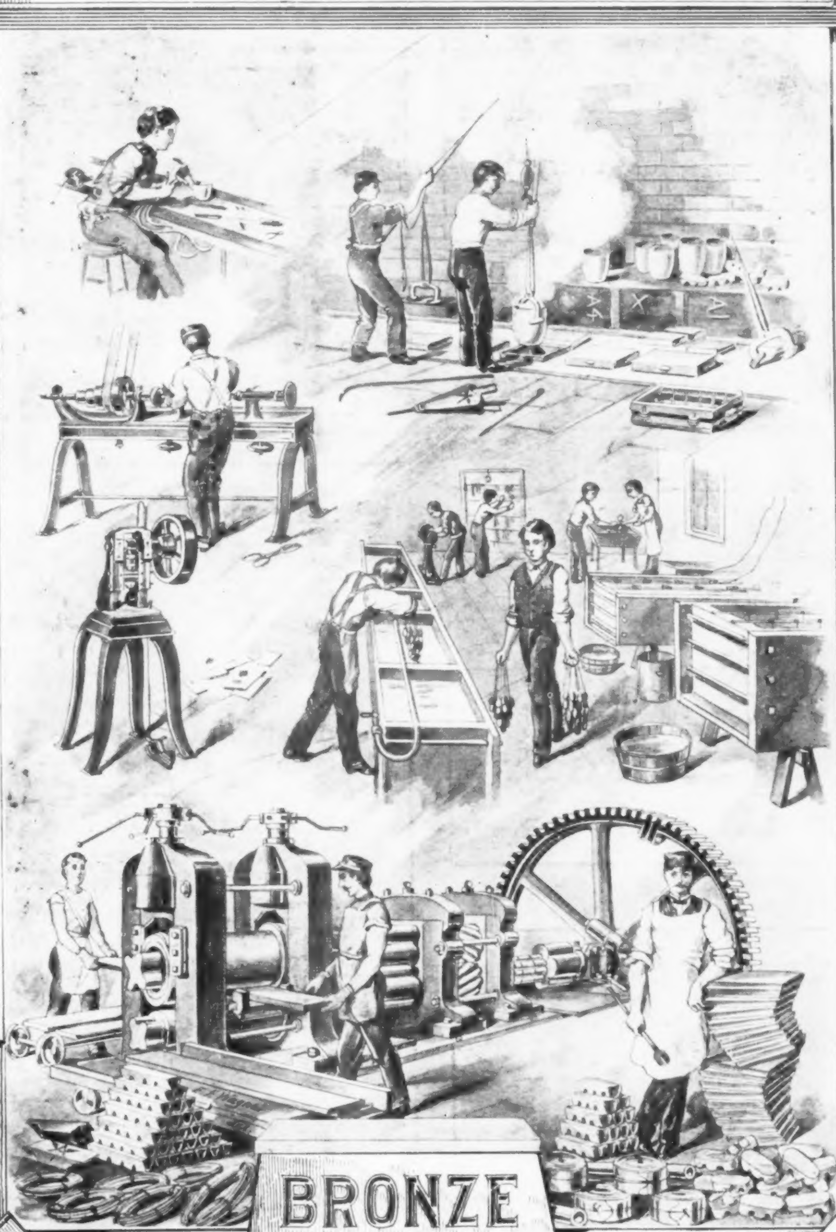
ALUMINUM · METALLOGRAPHY · BRASS · METALLURGY · COPPER

NICKEL · SILVER · GOLD

TIN · LEAD · ZINC

ROLLING · DRAWING · STAMPING · SPINNING · TUBE-MAKING · POLISHING ·

MELTING · CASTING · REFINING · SOLDERING · BRAZING · PLATING ·



BRONZE

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Vol. I., No. 3 NEW SERIES

LABOR OMNIA VINCIT
MARCH, 1903

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Entered February 10, 1903, at New York, N. Y., as second-class matter under act of Congress, March 3, 1879.

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ADVERTISING RATES ON APPLICATION

Entered February 10, 1903, at New York, N. Y., as Second Class Matter, Under Act of Congress March 3, 1879.

PRICING CASTINGS.

We are much gratified to learn that some manufacturers are at last taking the initiative in pricing castings. The usual method of making a price on a variety of patterns has always been a source of much dissatisfaction to foundrymen, although agreeable to the buyer. The buyer, of course, would rather have one price for all his castings than be bothered with keeping track of each individual casting. For this reason, accordingly, when a prospective customer has had a variety of patterns upon which he desired prices, he invited bids from the foundryman. The latter looks over the patterns (oftentime a large assortment and ranging perhaps from the very smallest to some of good size) and makes a flat price on the lot regardless of the tonnage he can turn out and the difficulty of molding.

Such a custom may have been productive of good results when the bidder formerly made a price on the light work (that which costs the most to make), and if any profit could be made on this, the larger castings would surely show more. The day of this sort of thing passed many years ago and the manufacturer has been obliged to average the lot in order to arrive at any estimate which will get the work. The initiative has now been taken, however, of making a separate price on each pattern based on actual cost of molding. The practice will eventually work out as well for the consumer as for the producer. The method of averaging the whole lot of castings as usually practised is so unsatisfactory and the factor of uncertainty so great that some facetious person has dubbed it "gambling in castings."

THAT AURIFEROUS ONE-CENT PIECE.

The persistent rumor in regard to the one-cent pieces of the date of 1902 containing gold still refuses to cease. Usually too ridiculous to warrant even passing notice, such statements are taken up by the newspapers and on this account many persons are inclined to give credence to them. Let us state in this connection that the one-cent

pieces of the United States are only partially made at the Government mint. The metal is cast, the sheet rolled, and the discs blanked out at a Waterbury brass mill. The coin is finished at the mint, a process which consists in stamping on the letters and other designations.

The fallacy of the rumor is quite obvious, therefore, but in order to avoid any possible chance of this unexpected condition happening we have tested several of these coins, but utterly fail to detect the slightest trace of gold in them. The alloy from which the one-cent pieces are made consists of copper, 95 per cent.; tin, 4 per cent., and zinc, 1 per cent.

ANNEALING TROUBLES.

Brass manufacturers who use soft coal for annealing are beginning to experience some troubles in this operation on account of sulphur in the coal. Before the commencement of the coal strike a certain grade of soft coal, low in sulphur, appeared to be the favorite, but at the present time manufacturers have been obliged to take what they can get, with the above results. The metal appears from the muffle covered with spots, which seem to produce cracks in the following operation. Our attention was recently called to a difficulty of this nature where certain streaks, resembling spills, appeared on metal after it had been slit for wire rods. Soft coal has never been a particular favorite in annealing, but the high price of oil, and likewise that of wood, in certain localities has forced soft coal upon manufacturers. The statement has been made that one rolling mill in the Naugatuck Valley used 14,000 cords of wood for annealing during the year 1902.

QUALITY OF BEARING BRONZES.

A railway master mechanic recently informed us that a good indication of the quality of bearing bronzes is in the heating of the chips when the bearing is being turned or slotted. In fact, he says that he has been accustomed to judge the quality of such bronzes by this means. By holding the hand under the cutting tool and catching the chips therein as they are removed, the heating quality of the metal is at once manifested. He furthermore informs us that the heating of the chips as they come from the tool appears to be directly proportional to the content of lead in the alloy; in other words, the more lead a bearing contains the less the chips heat. He has always found, he states, that if the chips heat as they come from the tool that the bearing will do likewise.

THE EMPLOYMENT OF WOMEN AS CORE-MAKERS.

There is a growing tendency to employ women as core-makers in the brass foundry. At first this practice was looked upon with much disfavor and the practice ridiculed, but at the present time there is an undercurrent of belief that much is to be gained by their employment. Of course, they are only employed in the manufacture of small cores, but in this class of work they appear to be much more adept than boys or men, and the amount of work turned out is greater. They are paid by the piece in the majority of foundries where they are employed. They are better suited to make and handle delicate cores than men or boys.

THE USE OF PURE NICKEL FOR COINAGE.

Various metals and alloys have been suggested or used for the manufacture of coins of small denominations, but recently pure nickel has become a coinage material. From a statement recently made in an Austrian paper it would appear that while nickel has been used to a limited extent for coins, its employment in this direction is increasing. The following taken from the *Oest. Zeits. fur Berg und Huttenwesen* explains the situation:

"The increased cheapness of nickel, owing to the large output of the Canadian mines, is leading to a more extended use of this metal. Only lately it was mentioned that the French Government proposed to use 400 tons in nickel coinage. Austria, it seems, is about to follow her example.

"At a recent meeting of the Austro-Hungarian Parliament, says Oberbergrath Ernst, it was proposed to issue 10 and 20 farthing pieces of pure nickel and 1 and 2 farthing pieces of bronze. After mentioning several alloys that have been tried and found wanting, among others the "packfong," containing 6 per cent. of silver, coined in Switzerland in 1860, he instances an alloy of 25 per cent. nickel and 75 per cent. copper as one which experiments have proved, with one exception, to be suitable for small coin. This alloy is cheap, durable and hard to counterfeit. Its hardness, compared with that of copper, is 3 to 2. It can only be coined with powerful and well constructed machinery, and the impression is sharp and clear. The one fault to be found with it is that while bright when new, it soon becomes dull and gives the offensive odor of copper. With the exception of Germany, all the large countries have ceased to coin this alloy.

"Nickel is especially suitable for small coins on account of its cheapness, durability, sharpness of impression, and, most important of all, its lasting brightness; but until a process for manufacturing pure nickel was devised at the Berndorfer Metallfabrik the metal could not be coined on account of its brittleness. In 1880-1881 Switzerland commenced the coinage of 20 rappen pieces of pure nickel, the dies being furnished by Krupp, of Berndorf. Krupp also furnished the plates for Mexico and Servia for their copper-nickel coins. While the former coinage of copper-nickel in Switzerland, Mexico and Servia took but 200,000 kilos (440,000 pounds), the proposed coinage of Austria will require not less than 1,050,000 kilos of pure nickel (2,310,000 pounds), and that of Hungary 450,000 kilos (990,000 pounds)."

[Apparently, the author of this article, from his remark about all the large countries having ceased to coin cupro-nickel, does not consider our great and glorious country within the category of even Switzerland. Our Government is still coining the five-cent pieces from cupro-nickel (copper 75 per cent. and nickel 25 per cent).

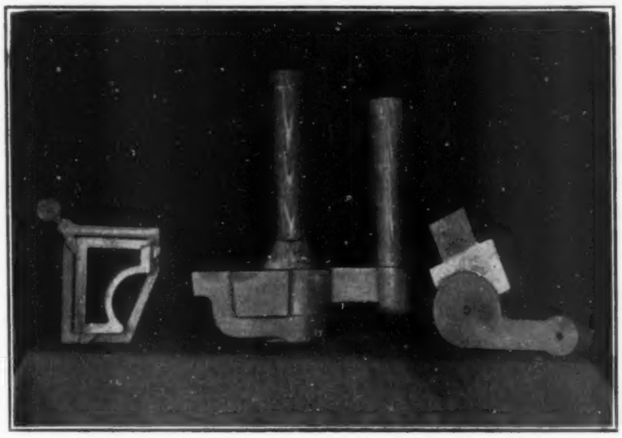
Krupp, of whom he speaks as the manufacturer of pure nickel, is not the late Herr Krupp of steel fame, but of Bernsdorf, a suburb of Vienna, Austria. We are informed, however, that he is a relative of the steel manufacturer. The Bernsdorf works is one of the largest brass and copper works in Europe.—EDITOR.]

The M. S. Benedict Manufacturing Company, manufacturers of silver-plated ware, with factories at East Syracuse, N. Y., and Ottawa, Ill., recently lost their president by the death of M. Stewart Benedict. Mr. Benedict was born in 1849 and, in connection with the town authorities, had taken a prominent part in building up the silverware industries at East Syracuse.

THE USE OF THE SKIM GATE IN MAKING SAND CASTINGS

By Erwin S. Sperry.

One of the most exasperating features in the manufacture of sand castings is the finding of spots or pockets of dross in the casting after the cope has been removed and the sand brushed from the surface. Many a casting otherwise perfect has been condemned for this very reason. While in iron castings the same difficulty exists that is found in brass or bronze, the requirements of the latter are so severe that a turned or finished surface is expected which will scarcely show a flaw. Blow holes are usually laid to the melter, but any dross or sand in the castings is commonly supposed to be the fault of the molder. Ordinarily, perhaps, it is, but I believe that there are certain cases where the molder does the best he can and yet imperfect work results simply on account of foreign matter getting in the mold. Were the skim gate used in these causes I believe that many of the troubles of the molder would disappear and a greater proportion of good work result. I know in my own case that not only many of the troubles of the foundry disappeared but certain work which previously could not be made was produced without difficulty by means of the simple skim gate.



C D B' A' B A

FIG. 1.—Skim-gate pattern and core box.

The skim gate is what its name implies, a device for skimming automatically, so to speak, the metal before it enters the mold proper. To the uninitiated, perhaps, this device might appear somewhat ridiculous as the agency of the skimmer at the mouth of the crucible or ladle is to remove any such foreign matter. While this is so to a certain extent, there are several reasons why a skimmer does not fully answer the purpose. In the beginning much dross, charcoal or flux floats by or under the skimmer, and so enters the mold. Then, too, particles of sand are dislodged from the spot where the metal first strikes. Again, some classes of alloys have a way of making dross as they run, no matter how carefully the skimming may have been done. This is especially true in such alloys as the aluminum bronzes and high brasses. It is in these instances where the virtue of the skim gate is manifested, although I have invariably found it to be a valuable adjunct in sand casting no matter what alloys are used; either in phosphor-bronze, which flows without oxide film or accumulation of dross, or aluminum bronze, the most difficult of all alloys to cast on account of its "drossy" nature. Even with phosphor-bronze there is danger of the sand becoming dislodged and particles of charcoal or slag entering the mold. Pieces of the crucible also have an annoying way of dropping off in the midst of a pouring operation, so that, after an experience of some time with the skim gate, I adopted the practice of using it on all particular work. Of course, small or other unimportant work does not need any such appliance in casting, as the labor and extra metal necessary only involves more expense. In large castings, and especially those which are to be machined, or are to stand pressure, the skim gate is an almost necessary feature of the foundry. The casting of large sized valves is an operation where the skim gate will be thoroughly appreciated and the waste from leakage much less than when cast without any such appliance.

There are many forms of skim gates used in foundries, but the one which I am about to describe is, it is believed, one of the best, and it certainly accomplishes the desired end. In Fig. 1 is shown the whole appliance. The skim gate proper is shown at the right of the figure. This is made of metal, and is swiveled so that the gate may be set at any angle. There are certain cases where the position in which the skim gate must be placed is such that the adjustment by the swivel is necessary. The angle so produced may be either one of 90 or 180 degrees. The place at which the metal enters is at the extreme right of the figure at A or A'. The metal then flows into b or b'. It will be noticed that this is set on a tangent, so that when the metal enters it is immediately given a rotary motion. Under the action of the centrifugal force the dross or other foreign matter is thrown to the top. The dross riser is shown in B', and this reaches out through the cope. It should not be a "blind" riser, but should be open at the top. All the foreign matter will be found in this riser, as is shown in Fig. 2. The metal now passes under a dry sand core, the core box of which is shown in C, and the core print is painted white at B. The core acts as a skimmer itself, although the spinning of the metal before it reaches the core is an important adjunct. In A and B in Fig. 1 two small holes are to be seen. These are draw holes for removing the skim gate. The draught of the skim gate pattern

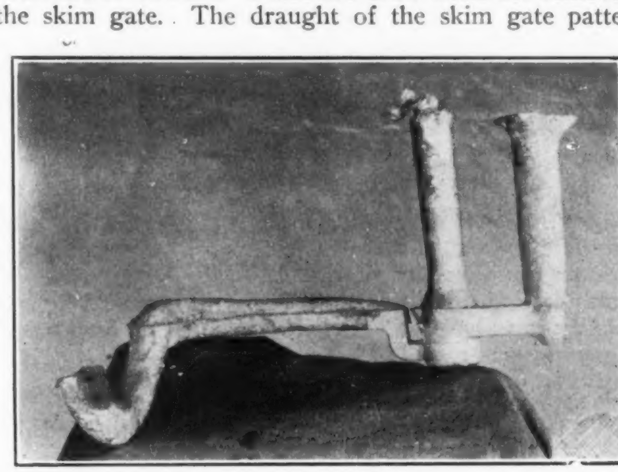


FIG. 2.—Skim gate with horn sprue after cutting from casting.

is entirely in one direction so that it may be placed on a board and immediately "rammed up" with a pattern which it is to serve. The mouth of the skim gate at D is either to be immediately connected with the casting or by a short runner. The latter I have found to be the best practice. Indeed, I have oftentimes found it advantageous to make the runner of some considerable length. In Fig. 2 the gate resulting from such a cast-

ing is shown. This particular instance was one in which aluminum bronze was used. The amount of dross riser and sprue are of wood, separate from the In this case, however, the skim gate was combined with a horn-sprue, which for certain classes of work is an excellent combination.

In the use of the skim gate much depends upon the proper proportion for particular sized castings. A small skim gate should not be used for a large casting, as the runner will not take the metal fast enough. The same objection applies to the use of a large skim gate for a small casting, except in this case the runner will take the metal too fast, so that it will not be properly skimmed by the core. The skim gate pattern from which the photographs were made has dimensions at D of ½ by 1 inch. This is sufficiently large for making a casting up to several hundred pounds. Above this the area should be increased.

To have the skim gate work satisfactorily a well-made pattern is necessary. That which is shown in Fig. 1 is an excellent example of the pattern maker's art. An iron core box with clamp and lugs and plenty of draught is an assurance of good work. These cores, by the way, should be made from coarse sand and well vented. A skim gate core which begins to blow during the pouring operation is sure to make an imperfect casting. The core print must be a trifle larger than the core so as to prevent the breaking of the sand by being obliged to force it in. Too much space, however, between the core and the sides of the print is a detriment, as it allows the metal to get into the core vents and produce blowing. The dross riser and sprue are of wood, separate from the main portion of the skim gate pattern and with sufficient taper to allow of easy and rapid removal from the sand. The skim gate pattern itself should have abundant draught so that no sand may fall to the bottom while being drawn out. Such loose sand is one of the careless results of poor patterns, and is sure to wash into the casting. For the most satisfactory working of this skim gate is it advisable to have the patterns made in rights and lefts so that the casting may be gated from either side of the flask. In doing this the runner which enters the main portion of the skim gate or that which is set on a tangent is placed on one side for the right and diametrically for the left. While this procedure is, of course, not imperative, it gives the molder a variety of skim gate patterns so that he need not spend any time in thinking how he will get the matter properly arranged.

BELGIAN BRASS.

Like American brass founders, the Belgians apparently appreciate the fact that lead is necessary for a free turning brass mixture. The following analysis was made on a brass casting made in Belgium, and upon which a very difficult thread had been cut. The casting had been made in green sand:

Copper	71.51 per cent.
Zinc	23.62 per cent.
Lead	2.98 per cent.
Tin	1.35 per cent.
Iron	.61 per cent.

A piece of this was drilled and turned with excellent results. The mixture is a very good one for yellow brass sand castings upon which much machine work is to be done and a free cutting mixture required.

Gold is green when in very thin sheets and seen by transmitted light. When leaf-gold is heated to 316° C., the green is turned into a splendid ruby color.

MELTING BRASS IN A CUPOLA.

Many persons are unable to understand why brass cannot be melted in a cupola in the same manner as iron, and instances are known where iron manufacturers have entered into the manufacture of brass castings, and have actually attempted to melt their brass in a cupola instead of using the time-honored method of melting in crucibles.

The ideal method of melting would be one in which the metal would be put into the fire in a hermetically sealed recepticle and a vacuum produced so that no air or gas of any kind could come in contact with the metal. If such a process were possible, perfect results would probably be obtained. A method of this kind, however, is practically impossible, and the nearest approach to it is the ordinary crucible. It seems to be an invariable rule that the best results are obtained in melting metals in crucibles or where they do not come in contact with the fuel or the products of combustion. Steel of a quality equal to that made in crucibles has never been reached by the open hearth or bessemer process, and so brass always gives better results when melted in crucibles than it otherwise does.

The more the metal comes in contact with the fuel and products of combustion the worse it is. Brass melted in crucibles is better than that which has been so treated in a reverbatory furnace, and brass melted in cupola is the worst of all. The reason for this is the intimate contact of the metal and fuel so that not only is the metal brought in contact with the fuel itself but the products of combustion as well. Gases and sulphur are absorbed and the air blast tends to oxidize the metal and produce a dirty metal, full of blowholes.

The story is told of a Connecticut machinery manufacturer who, thoroughly imbued with the idea that a crucible was a useless appurtenance in the foundry, attempted to melt a quantity of yellow brass in a cupola, and when the tap hole was opened no metal ran out. When the cupola bottom was dropped a mass of coke and dross fell, but no metal could be seen, it had oxidized and ceased to exist in the metallic state. Ordinarily the conditions are not as bad as this, for some metal will run out, but the quality is scarcely good enough for the cheapest work.

It was our good fortune at one time to witness the making of a large bronze gear at the railroad shops at Two Harbors, Minn. While the foundry possessed one brass crucible furnace, it was not of sufficient capacity to melt the required quantity of metal, so the cupola was brought into play. The gear weighed about 500 lbs., the metal was a straight gun metal (88 copper, 10 tin and 2 zinc), and had previously been made into ingots in the crucible furnace. The metal, when poured, ran thick and sluggish, and was completely filled with numberless blowholes, large and small, so that the casting more resembled a bee hive than a casting. The teeth were cut in the gear, and all the machine work done and the gear put in use, and, so far as we know, is working yet. Had the company not intended to use it themselves the casting would probably have been broken and melted, for no customer would have accepted it.

It can hardly be said, therefore, that the use of the cupola in brass melting is a particularly promising field. Reports are heard now and then of various concerns who are using a cupola for brass melting, but our experience has been limited, in active personal contact, to this particular instance. The cupola, if employed at all in the brass industry, is quite limited in its use.

THE ANNEALING OF BRASS.

The microscope is an instrument which is proving of great value in the investigation of the properties of metals, and has for some time been used in the examination of steel. Its employment in the study of the copper alloys has not been productive of the results that have been manifested in the metallurgy of steel, probably on account of the small amount of work which has been done along practical lines. The subject of the annealing of brass and kindred alloys is a wide field for such investigations, for there is no process in the metal industry which gives more unreliable results than annealing. When difficulties occur, as thy repeatedly do, the manufacturer is at loss to find their cause. E. A. Lewis,* of Birmingham, England, the center of the English brass industry, has made a study of the annealing of brass rods both with the use of the pyrometer and the microscope, and has arrived at some very interesting results. His experiments were conducted on a Muntz metal rod ¼ in. diameter. The analysis of the rod was as follows, viz.:

Copper	61.49 per cent.
Zinc	38.25 per cent.
Lead	0.24 per cent.
Iron	0.02 per cent.
Tin	None
Total	100.00 per cent.

This rod had been rolled hot from a 3-in. billet., and then cold drawn. The rod was in its hardest condition. The rod was cut into pieces two inches long and annealed in a gas muffle connected with an electric pyrometer. The temperature of the annealing was noted and then some of the pieces were allowed to cool slowly and others quenched. The surfaces were polished and etched with ammonia, and then examined under the microscope. The effect of the different methods of treatmnt is quite apparent in the reproduction of the photographs of the etched surfaces. In Fig. 1 is shown the etched surface of the rod taken lengthwise of the rod, while in Fig. 2 the cross section is reproduced. All the others were sections cut across the rod or vertical sections, as he calls them.

The following conclusions were made, viz.: That the structure of brass of the above composition (or Muntz metal) is composed of two different constituents or alloys, one of which solidfies before the other. He says: "It is evident by the experiments carried out that the annealing of Muntz metal or similar brass alloys is best carried out at a four-hour annealing at not more than 1,000° Fahrenheit rather than a quick annealing at 1,100° to 1,300° Fahrenheit. A long heating at 850° Fahrenheit causes one of the constituent alloys to dissolve in the other until it has disappeared, and the structure is similar to Fig. 9. I do not think that it has previously been noticed that the structure of burnt brass can be developed at so low a temperature." As the temperature of annealing is raised it gradually throws the dissolved allow out of solution again until the structure is coarse and has the characteristics of burnt brass. The structure of the metal after various treatments is shown in Figs. 1 to 13.

He further says: "A seven-hour annealing at 1,100° F. is sufficient to induce a coarse structure in the metal, and after heating to 1,300° F. for seven hours the metal is burnt; although heating the metal for half an hour at 1,300° F. causes a coarse structure it is not burnt."

*Jour. Soc. Chem. Industry, January, 1903. Page 12.

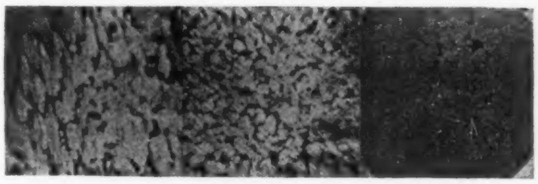


FIG. 1 FIG. 2. FIG. 2A.

FIG. 1.—Muntz Metal Box, Hard, Longitudinal Section.
FIG. 2.—Muntz Metal Bar, Hard, Vertical Section.
FIG. 2A.—Muntz Metal Bar, Annealed at 850° F. for ½ hour and slowly cooled.

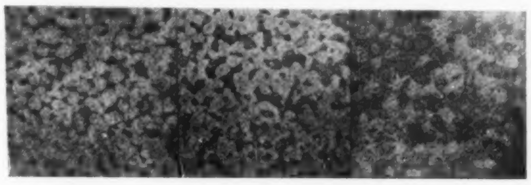


FIG. 3. FIG. 4. FIG. 5.

FIG. 3.—Muntz Metal Bar, Annealed at 1,100° F. ½ hour and slowly cooled.
FIG. 4.—Muntz Metal Bar, Annealed at 1,100° F. for ½ hour and quenched
FIG. 5.—Muntz Metal Bar, Annealed at 1,300° F. for ½ hour and quenched

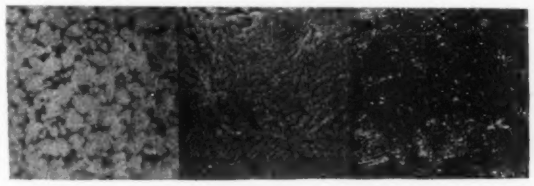


FIG. 6. FIG. 7. FIG. 8.

FIG. 6.—Muntz Metal Bar, Annealed at 1,300° F. for ½ hour and slowly cooled.
FIG. 7.—Muntz Metal Bar, Annealed at 1,500° F. for ½ hour and slowly cooled.
FIG. 8.—Muntz Metal, Heated to 1,500° F. for ½ hour **and** slowly cooled.

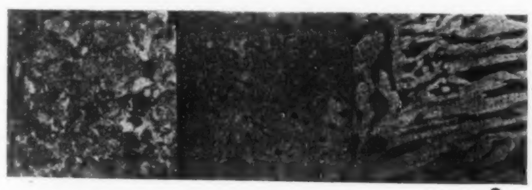


FIG. 9. FIG. 10. FIG. 11.

FIG. 9.—Muntz Metal Bar, Annealed at 1,500° F. for ½ hour and quenched.
FIG. 10.—Muntz Metal Bar, Annealed at 850° F. for 7 hours and slowly cooled.
FIG. 11.—Muntz Metal Bar, Annealed at 1,100° F. for 7 hours and quenched.

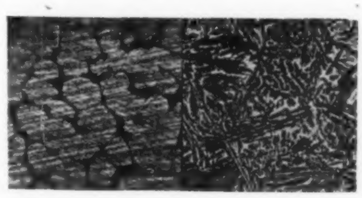


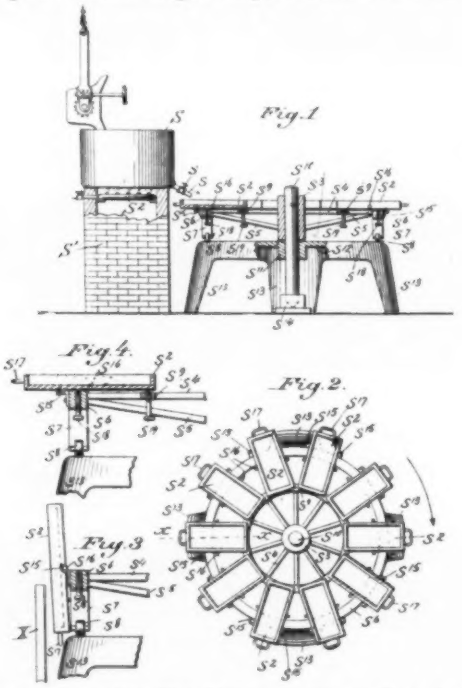
FIG. 12. FIG. 13.

FIG. 12.—Muntz Metal Bar, Annealed at 1,100° F. for 7 hours and slowly cooled.
FIG. 13.—Muntz Metal Bar, Annealed at 1,300° F. for 7 hours and slowly cooled.

Cross-rolling is a term used to indicate the process of widening a plate of metal during the "breaking down." In rolling, a sheet does not spread much in the rolls, and if a plate 8 inches wide is cast and a sheet 10 inches wide is required the cross-rolling process must be followed. In cross-rolling the plate is put diagonally through the rolls and not, as the term would indicate, the full length of the plate.

THE CASTING OF ZINC PLATES.

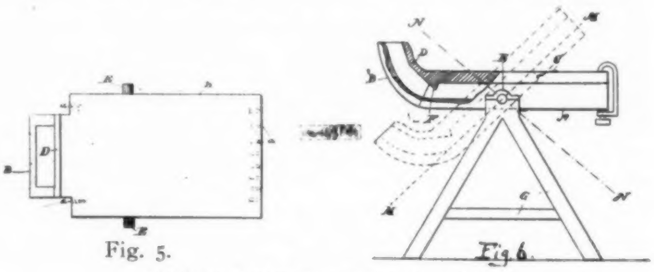
Zinc is a difficult metal to cast. It is quite "drossy" when melted, and is very apt to crack unless allowed free space for contraction. In the manufacture of zinc plates or slabs for the market the smelters are cast in open molds, and such a process is undoubtedly the easiest and most satisfactory for the purpose. To be sure the dross floats to the top, but in a well cast plate there is little to be seen, and if the temperature is low in pouring there is not much crystallization noticed. If the heat of pouring be high, however, the tops of the plates will not only be dirty, but the last portion to cool will show the characteristic crystallization "set" marks often noticed in commercial spelter. For the ordinary uses of spelter such as in the manufacture of brass or remelting for other purposes these slight imperfections are of no consequence except in the matter of rendering the plate more or less unsightly in appearance. The average plate of spelter found on the market, however, at the present time presents an excellent appearance, and indicates that care is taken in the casting.



Mechanism for Casting Zinc Plates. In use by W. & J. Lanyan.

The usual mold for casting such plates is simply a pan-shaped mold about ¾ in. thick on all sides in which the metal is poured, and when cool removed by inverting the mold. Messrs. W. & J. Lanyan have recently invented a form of mechanism (U. S. Pat. 644,713) which permits of casting the zinc slabs continuously. The molds, which are the usual form of zinc mold, are set on a turn-table, which, by revolving, brings each mold under the ladle from which the metal is poured. This ladle is the mixer, so to speak, into which the zinc is poured, and is kept hot by means of gas jets underneath. Each mold is on trunnions, so that the plate or slab may be easily removed by inverting or turning the mold. Set screws for leveling the molds are a part of the mchanism, and are a valuable adjunct, as the thickness of the slab of spelter is then uniform. This apparatus represents a marked advance in the testing of zinc.

There are certain cases where a plate of zinc is required which shall be the same on both sides similar to a brass plate used for rolling. This requirement cannot be well fulfilled in an open mold, but to render the casting smooth a closed mold must be employed. The ordinary brass mold does not work as well as might be desired, and for this reason a mold*, shown in Figs. 5 and 6, is employed. The mold is similar to a brass mold, except that it is placed on trunnions. One end terminates in a spout. To begin the pouring operation the mold is inverted, as shown by the dotted lines MM. The metal is poured in the spout B and at the same time the mold is gradually turned towards the horizontal position. The metal flows upward, so to speak, and the projection F acts as a skim gate and checks any dross which may tend to flow with the metal. When the pouring is finished the mold has a position shown by the line NN, which is exactly opposite from the position at the beginning. Small vents, indicated by a, allow the egress of air. This mold is applicable for casting zinc plates for rolling battery plates or similar castings which require smoothness and uniformity on both sides.



Mold for Casting Zinc Plates for Rolling.

A METHOD FOR TESTING THE QUALITY OF ZINC.

It is well known among the makers of fancy zinc castings that only the purest zinc will answer the requirements of the process; other kinds crack in the mold. Whether this is caused by the lead or sulphur, either individually or in combination, is unknown, but the fact remains that only pure zinc will answer. Bertha zinc is the favorite as well as the most expensive, but it has been recently demonstrated that some other brands answer equally as well, probably on account of their high degree of purity. The fact that pure zinc does not crack and common grades manifest this difficulty, has been suggested to us as a method for testing the purity of the metal. A standard form of mold was suggested in which pure zinc would give no trouble about cracking, while common spelter would invariably do this. By the use of such a mold the line between high and low grade spelter could easily be drawn. This is merely a suggestion, but one worthy of trial on account of its simplicity.

EXPANSION OF BISMUTH.

Bismuth expands when it solidifies, but after such an expansion has taken place it follows the regular law of expansion and contraction. This may be readily demonstrated by casting bismuth in a mold, say one which is about a foot long and not too wide or deep—a mold similar to that used for casting solder is suitable. If such a mold is employed the slight shrinkage may be noticed as well as the expansion at the moment of solidification. This expansion, however, is best demonstrated by pouring bismuth in a thin glass bulb. Although the glass remains intact as long as the metal remains melted, as soon as solidification follows the glass is shattered by the expansion. Cast iron or any brittle substance is shattered in the same manner if the bismuth does not have space for free expansion.

*Invented by Wm. S. Platt, of Waterbury, Conn.

ALUMINUM BRASS

By Erwin S. Sperry.

One of the early attempts to use aluminum in alloys was in those of copper and zinc or copper, tin and zinc. The results were quite surprising in some directions and quite disappointing in others. A slight addition of aluminum in yellow brass was found to impart remarkable casting qualities to it; in fact, certain high brasses which had, heretofore, been thought impossible to cast successfully in sand, gave such surprising results that it would seem that the entire character of the alloy had been changed. A great future of such an alloy was predicted, and its very properties were sufficient to advertise itself. Like all aluminum alloys, it had its ups and downs, not in this case, however, about the quality, as the value of aluminum in brass was fully appreciated, but on account of the great difficulty in casting it. I believe that, without exception, aluminum brass made according to the formula originally used (copper, 63.33; zinc, 33.33, and aluminum, 3.34%), the most difficult alloy to successfully cast in sand that is in existence. There are three difficulties in the way: First, its great shrinkage; second, the red shortness which renders it very apt to crack; third, the oxide of aluminum which gives the casting a dirty appearance.

Let me say in the beginning that the value of aluminum in brass is confined wholly to the yellow brasses; the red brasses do not need any addition of this element to make them suitable for casting, but, in fact, are actually deteriorated by such an addition. No greater injury can be done to a steam metal mixture, for instance, than to add aluminum to it; the castings made from it will invariably leak. It is in the yellow brasses very high in zinc, such as the well known yellow and Muntz metals and mixtures even higher in zinc, that the value of aluminum is demonstrated. One point not throughly appreciated is the fact that aluminum should *not* be added to brass to be cast in metal molds such as those used for casting plates, bars and tube-shells. The very property which renders aluminum brass so suitable for sand casting makes it unfit for rolling mill work. The explanation is in the fact that a film of oxide of aluminum is invariably present on the melted metal which burning hydrocarbons (oil) will not reduce. The plate, billet or tube-shell, therefore, if cast from brass containing aluminum, will surely be "spilly," no matter how carefully the pouring has been done and how well the heat has been regulated. Aluminum, therefore, is a metal which should be carefully guarded in the rolling mill casting shop. Even as low a percentage as 0.02 per cent. will cause brass to be "spilly" so that the wisdom of keeping aluminum away from such work may be readily appreciated.

In sand casting, however, the situation is diametrically opposite. Let us take for an example a very high brass containing, say, 55 per cent. of copper and 45 per cent. of zinc. This is an excellent alloy for work requiring a strong metal, especially if a small amount of tin be added (about 1 per cent.). If we attempt to cast it sand, even at quite a low temperature, the result is a casting completely filled on the surface with dross and oxide of zinc. Even careful and painstaking work fails to obviate this. It has often been said, not wholly meaningless either, that such a mixture cannot be cast in sand. But add a little aluminum to it and there is produced an entirely different casting. The surface is bright and uniform in color, the corners have run up sharply and one would scarcely imagine that the alloy was practically the same. It is in this class of work that aluminum is advantageous.

Aluminum, however, may be added to brass for two purposes. First, to render the metal capable of being cast in sand, acting, perhaps, more in the nature of a flux than otherwise; second, to increase the strength of the alloy. Let the first case now be treated. Much care should be used in the use of aluminum for the purpose of fluxing the metal, so to speak. Only work which will admit of it should be so treated. A very slight amount of aluminum will answer, and if more is used the shrinkage will be increased without any advantage in the way of fluxing the metal. For this purpose about 0.05 per cent. of aluminum is all that is required. Such a slight addition will not appreciably increase the shrinkage and will give to the metal those free running and clean-casting properties so necessary in small gated work. The novice would, perhaps, be somewhat skeptical about this amount of aluminum being sufficient, but a simple trial will certainly convince him that it is true. While quite small, to be sure (0.05% of aluminum is equivalent to about ¾ oz. to 100 lbs. of metal), this quantity gives the desired result. To add much more renders the metal hard and greatly increases the shrinkage. To add less defeats the attainment of the results. In an experience extending over a considerable period I found that this amount is amply sufficient.

It is in the use of yellow brass scrap that this minute amount of aluminum is valuable. Ordinarily such material is difficult to cast soundly, but by the addition of aluminum this trouble disappears. The corners and thin parts "run up" full, the castings are clean and free from blow holes and more pieces may be put on a gate, as the metal will run a longer distance without chilling. This latter property is an important desideratum in cheap brass work, as it not only enables the work to be made in snap flasks, but increases the output. Without the use of aluminum difficult or, in fact, nearly all yellow brass work must be cast on end, as without this method the work will not run. The addition of aluminum enables the metal to run so freely that it will work equally as well when poured "flat."

In the use of aluminum for making the strong aluminum brasses the amount of this element which is added must be very much greater than in the previous case. Two classes may be designated. Ordinary aluminum brass containing:

Copper	63.33
Zinc	33.33
Aluminum	3.34
	100.00

This alloy is very strong and will give in ordinary green sand between 70,000 and 80,000 lbs. per square inch. A test bar cast horizontally of the above mixture in green sand gave the following results:

Diam. (turned)	1.170 in.
Broke at	83,600 lbs.
Tensile strength per sq. inch	77,000 lbs.
Elongation in 8 in	6 per cent.

It may readily be seen, therefore, how strong this alloy is. In casting, however, larger risers must be used and only plain shapes attempted, otherwise the castings will crack. This latter tendency is considerable; in fact, more than I have ever seen in other alloys.

It is an amusing fact that the early opponents of aluminum alloys were the makers of manganese bronze. These people became quite antagonistic in their opposition, and much bitter strife ensued. The humor of this condition will be appreciated when I call attention to the fact that manganese bronze used for sand castings contains about 0.50 per cent. of aluminum, added for the purpose of giv-

ing sound sand casting properties. Without the aluminum manganese bronze would be useless. An analysis of Parson's manganese bronze, made in England some four or five years ago, gave the following results, viz:

Copper	57.30	per cent.
Zinc	40.44	" "
Tin	1.01	" "
Iron	.79	" "
Aluminum	0.46	" "
Manganese	trace	
	100.00	

This alloy, while not as strong as the alloy usually called aluminum brass, and a test of which is given above, has much better casting properties and is not so liable to crack. The shrinkage is very high, however, and consequently large risers must be used.

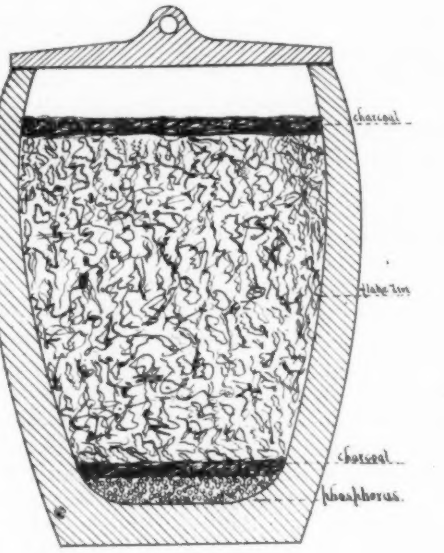
THE MANUFACTURE OF PHOSPHOR-TIN.

The manufacture of phosphor-alloys directly from phosphorus is a process which the foundryman usually has tried to avoid. His early experiences led him to do this. The danger of handling the phosphorus and the lack of uniformity of the product are, of course, the obstacles in the way. Phosphor-tin containing about 5 per cent. of phosphorus is the best means for introducing phosphorus, provided, to be sure, that tin is desired in the alloy. If it is not then phosphor-copper must be used. Tin is always present, however, in the usual bronze mixtures found in the foundry, and, therefore, phosphor-tin forms a ready means for introducing the phosphorus. A simple and satisfactory method of making phosphor-tin, and, at the same time one free from any dangerous features, is the following:

In the bottom of a cold crucible (the larger the better) place some stick phosphorus and immediately cover to a depth of about one inch with powdered charcoal. The crucible is now filled nearly to the top with granulated tin (often called flake tin). The amount of the granulated tin which is used should be about ten times that of the phosphorus. In other words, ten pounds of granulated tin should be used to one pound of phosphorus; inasmuch as this form of tin is quite bulky the necessity for a large crucible is apparent.

The granulated tin is made as follows: Ordinary block tin is melted in a ladle or any convenient vessel, and when at a low, red heat is poured in a small stream into cold water. The stream of metal should be given a circular motion while being poured so as to avoid having the metal strike in one spot. The water should be cold and the ladle held at some distance above the surface of the water, as otherwise the tin will form shot, which will not give the desired result. If this operation is well done the tin will be in the form of flakes similar to large snow-flakes, and present a large amount of surface; a necessary feature for the success. This flake tin should be dried previous to inserting into the crucible.

After the tin has been introduced into the crucible the top should be covered with powdered or granulated charcoal and a lid put on. The crucible is now placed in a furnace and gradually heated. No coal need be packed around the sides of the crucible, but a good bottom in the pot-hole is all that is necessary. When the bottom of the pot begins to heat, the phosphorus is volatilized and combines with the tin. Some, however, burns at the top of the crucible, and is an indication that the process is going on all right. When this flame ceases the operation is finished, and the lid may be removed, the metal stirred and poured into ingots. The crucible need not be heated above a low red and the heat should be gradual. It is needless to add that the phosphorus must be kept under water until used and then handled with tongs. It need not be dried before using, but may be placed damp in the bottom of the cold crucible; in fact it is better to have it a little moist as it does not then ignite spontaneously. If trouble is experienced in this direction cover the phosphorus with a little moist sand when it is first put into the crucible.



In the sketch the general arrangement of the crucible, phosphorus sticks, charcoal and lid are shown.

ON THE USE OF PHOSPHORUS.

One of the greatest mistakes in making phosphor bronze is adding too much phosphorus. The directions often given not only recommend too much phosphorus, but also to increase the amount as the tin is increased, when, in reality, the opposite is necessary.

In making sand castings the amount of phosphorus should not exceed 0.10 per cent., as the best results are obtained with this amount. If 5 per cent. phosphor-tin is used, it will be necessary to add 2 pounds in 100 pounds of mixture. We believe most of the unsatisfactory results are obtained by the employment of too much rather than too little phosphorus. The amount given above is right for alloys which are free from zinc. An excess of phosphorus causes the tin to liquate and produces blow-holes. The sand also sticks to the casting to a far greater extent.

Charcoal which is used for covering metal which is melted in crucibles should not be allowed to remain in too large pieces. Ordinarily charcoal is made in large masses, which require breaking up before it is serviceable as a covering for melted metal. Large pieces in the crucible renders the stirring quite difficult and also allows air to enter. On the other hand, powdered or granulated charcoal, while an effective covering, is difficult to remove before pouring. The best results are obtained if the charcoal is in pieces about the size of a walnut.

Rawhide mallets are one of the useful foundry tools. For rapping patterns there is nothing equal to them, as they are not only light but do not injure the pattern.

PRINTING DEPARTMENT.

In this department we will prepare articles on the subject of Printing from Metals in reply to any questions asked by our readers. Address THE METAL INDUSTRY, 61 Beekman Street, New York.

Hygrol Colors.—In answer to a St. Louis lithographer, who is interested in the hygroscopic inks mentioned in our February issue, we would say that the demonstrations (sampes sent us) were from European houses of good repute, but not satisfied with this we have sent for some samples of these colors, in order to try them under our own observation, and our printing department will report fully upon all matters of interest in this respect in one of the next numbers of The Metal Industry.

DECORATING METAL WORK BY LITHOGRAPHY.

By E. F. Wagner.

The artistic embellishment of all things of utility, be they of metal, wood, glass or earth, is always one of the most important parts of the manufacture of such articles. Every manufacturer knows that if two pieces of machinery, say two sewing machines, be they of equal merit, the one which has the more handsome embellishment, the more harmonious color scheme, or artistic decoration will sell the more readily. Therefore the question arises how can surfaces of that kind be treated so as to get the finest result with the least expenditure of money and time.

We find that lithography here offers the solution by its ability to print these decorations upon a transfer paper and then offsetting them to the painted surfaces, and either burning them in, to resist the most severe wear, or covering them by a lacquer without any further application of heat. The process is the following:

After a design has been made of the different parts to be decorated the work is put upon stone or metal plates in the usual method by an engraver or lithographic artist, either by engraving, stippel or crayon work. The subject being either adapted to the one or the other class of work; then a paper is prepared in the following manner:

First.—Take ten parts of ordinary commercial gelatine and soften in 300 parts of cold water; then pour in hot water to dissolve; add to this mixture three parts of glycerine, stirr well and strain. Take some unsized paper of a pretty tough consistency and spread the above composition thereon with a sponge; a broad bristle brush may be found by some lithographers to be more serviceable. Any one may follow his own inclinations in this respect. Then lay the freshly coated paper upon large, clean glass plates. The paper will readily come off when it dries.

Second.—Now take fifty parts of starch and ten parts of gum. tragacanth; soak the latter, then take about 350 parts of water and boil the starch. This is done in the usual way by stirring in starch when water is cold and then bringing gradually to boiling point; about 250 parts of water are used to soak the gum. tragacanth in. When the gum is thoroughly saturated and the starch boiled to almost the proper consistency, add the tragacanth to the boiling starch and allow the whole to boil up for a few seconds.

This mixture is strained through muslin and is ready to be applied to those sheets which were coated and dried before. The paste is put on very evenly and as thick as possible. Then the sheets are placed on the same glass plates as before and dried. This paper will remain effective for months. Now having had your color stones made and the proofs determined upon in the regular way, proceed to print the color plates; but in their reverse order. If the work contains gold bronze, print that last; finally print a heavy body color of zinc white over the entire work. This white, of course, serves as a background, and any other color can be used, provided it is a heavy body color; but if, for instance, an ornament should be printed upon a black enameled substance, like parts of a sewing machine, then no background at all is required.

The last procedure is as follows: The print, with the decoration or picture, printed in its reverse order is laid face up in water for a minute or so, a thin, even coat of varnish is applied to the subject to which the decoration is to be applied, then the print is taken out and without any water standing on its surface it is pressed down upon the object and where possible a small roller with a handle is used to squeeze the work from the paper to the metal. The printing ink which had been upon the paper in a reversed order will, of course, appear now as the proof did, which was first taken from the stones, and will combine pretty thoroughly with the varnish which was placed upon the metal before squeezing.

Still, to make almost indestructible decorations, either a shellac varnish is applied over the whole work or the subject is placed in a drying oven, registering a pretty high temperature. When, however, it is desired to amalgamate a design with a glaze then ceramic colors must be employed, which is an entirely different field, as the colors can only be made of earths and are subject to great change from their original hue, the operator depending upon the agency of the fire to change them to the predetermined shades.

DECORATING ALUMINUM PLAQUES.

For a beautiful decorative method which can be practiced by any one even of an inartistic temperament we recommend the "Indestructible Litho Shading Films." These are transparent, animal substances of the clarity of glass, stretched out flat upon a frame having a design in relief of either a stippel tint, lines, rulings, dots, shadings, grains, etc., and by crossing will produce unique patterns and geometrical figures which could not be produced by the most mathematically constructed lathe. These films are inked up with a strong, acid resisting ink, and then laid upon the metal (aluminum, brass, copper or other flat substances to be decorated), and the ink is transferred to the surface by pressure upon the back. The film being quite transparent the design can be cut out in a paper frisket and laid down first upon the metal. Certain sections can be shifted by a micrometer attachment so as to produce a heavier shading in places; the frame containing the film can be removed for re-inking and placed again in the exact same position. Finally the transferred part upon the metal can be dusted over with rosin powder and subjected to a severe etching, which will raise the ornamental work and perpetuate the design upon the metal.

If it is desired to produce shading on lettering or other intricate ornamental work, the small clear places can be gummed out with a fine brush and afterwards washed off with water (the water will carry the gum away with that part of the design not wanted, the places that have not received any gum will remain). It can easily be seen what an immense field for decorative art upon fine metals, etc., can be hereby opened up equal to fine engraving and made of lasting benefit to all. For printing plates, especially for color work upon the type press, these "litho shading films" are invaluable: clouding, foliage, gradation of all strengths and shades can be produced therewith, and in lettering and ornamental art there is no method, either of machine or hand work, which excels it in clearness, beauty, rapidity and simplicity of execution.

BLACK SILVER ANODES.

By H. H. DeLoss.

The silver-plater will need no introductory remarks about black silver anodes; his experience has made him thoroughly familiar with this great obstacle in the silver-plating industry. To those who are not familiar with this condition, let me say that a black silver anode is one which was pure white at the time it was put into the bath, but during the plating process changed, superficially, to a grayish black. The entire anode does not change to this black color, but a film forms over the surface as the silver dissolves away under the action of the current. Little by little the deposit accumulates so that at the period when it can no longer adhere to the anode it floats away and settles on the work which is being plated, and produces a bad deposit of silver. So much trouble has been experienced in this respect that some platers who are desirous of doing the best possible work have been accustomed to hang muslin bags in the plating vat in order to intercept this black flotant material, and so prevent its adhering to the articles at the cathode. This practice, while it appears to produce the desired results, is open to more or less objection on account of the prevention of the free circulation of the solution and the bother of keeping the muslin in the bath. Many platers, however, do not go to this trouble, and have begun to accept the black anode as inevitable, and have ceased to complain. This would be very well were it not for the fact that, oftentimes, anodes will not turn black at all, but remain white through their entire life. It was this disparity in results that made the problem so perplexing.

Carrying out an investigation with the attempt to solve the problem it was at first supposed that some foreign substance existed in the bath, and that this would cause the anode to blacken under the influence of the current. The fact that bisulphide of carbon is employed to give a bright plate which needs no finishing, but may be sold as it comes from the bath, imparted the idea that sulphur also might be the cause of the difficulty. The fact that new baths and those free from the bisulphide gave equally bad results conclusively indicated that the difficulty did not lie in the presence of foreign matter or in the use of bisulphide of carbon. The condition of the current was next investigated, and while it is a well known fact that the anode will turn black in the cyanide bath if the voltage runs too high, there is not much difficulty experienced in this respect, as the ordinary platers' dynamo is incapable of giving much over five volts. The plater, himself, knows that he can have a black deposit on the anode if the voltage runs too high, and, therefore, he is on the watch for such an indication.

The black deposit in such a case immediately forms in a large mass or a spongy deposit, which is easily recognized, as it is quite different in appearance from the ordinary deposit of a black anode. After a thorough investigation of the results of high voltage the conclusion was reached that the black anode as it is ordinarily found must be caused by other conditions. The black spongy deposit produced by such an abnormal voltage is the peroxide of silver, and there appears to be little trouble caused by it. The plater knows how to remedy this difficulty when it appears.

It soon became apparent, then, that some other cause was responsible for the blackening of the anodes, and the plater was at last exonerated, and the refiner took the blame upon his own shoulders. In connection with the question of black anodes let me say that the purity of the silver has never been questioned in the trade without the anode maker being vindicated. At first thought the layman would suggest that the anode was impure. This has not been found to be the case, as in every case where the anode was assayed it was found to be of a purity of 999 or over. The very purest of commercial fine silver and that made by the United States Government itself is sold on the market as 999 fine; such a fineness being the highest degree of purity that is attempted. In connection with the blackening of the anodes, it may be stated that the purity of the silver was invariably found to be normal, and as far as I know the questioning of purity has never been raised beyond the mere suggestion.

Brought face to face with the knowledge that the black anode was the fault of the refiner and not of the plater, the firm* of which I am a member some time ago began a series of investigations which have resulted in the entire elimination of the black anodes. The silver is subjected to special treatment which, although not reducing the fineness in any way, renders it impossible for the anode to blacken in the bath. In other words, a black anode indicates that the fault lies in the silver. This process of treating the silver has proven so satisfactory that it is now our practice to furnish anodes which are not only over 999 fine, but which will not blacken in the plating bath. Without any hesitation, therefore, the frank statement can be made that black anodes are a thing of the past.

ELECTROLYTIC GOLD.

There has always been an undercurrent of antagonism against metals refined by the electrolytic process. Such a feeling has, no doubt, been brought about by the poor quality of electrolytic copper which was produced in the first stages of the industry. This feeling ought to be dispersed at the present time in regard to electrolytic gold which is now being produced at the United States Government Mint at Philadelphia. According to D. K. Tuttle,* the refiner, this gold is of a purity never before obtained by any commercial process. The gold is refined by the Wohlwill process, a German invention. The process is conducted in a hydrochloric acid solution, and, provided the voltage is kept normal, nothing but gold is deposited on the cathode. The silver, which in the old process of parting gold and silver is quite difficult to entirely eliminate all remains in the form of an insoluble chloride. The gold bars produced by this process at the mint are of exceptional purity and averages as fine as 999.8. The gold is deposited at the cathode in a spongy form, which is exceedingly soft. As an experiment indicative of this high purity and consequent softness, some of this spongy gold was pressed into a die from which a medallion head of Washington had been struck. The result was a beautiful medal too soft, of course, for wear, but possessing every other indication that it had been made from sheet. This gold is now being sought by many users, especially makers of dental gold and leaf.

NICKEL WIRE IN NICKEL PLATING.

The use of hooks of copper wire in suspending nickel anodes in the plating bath is apt to contaminate the bath with copper, as this metal is acted on by the solution. Nickel wire is now sold on the market, and when the highest grade of work is desired it should be used. Although nickel wire and sheet is now used to some extent in this country, there appears to be no one who manufactures it in the United States. As far as known, it principally comes from a German nickel factory.

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*Handy & Harman.

*Electrochemical Industry, January, 1903.

A SCOVILL MEDAL.

The Scovill Manufacturing Company, of Waterbury, Conn., recently presented each of its stockholders with a handsome bronze medal, commemorative of the centennial of the founding of this company. The Scovill company is the oldest brass company in the United States, having been founded in 1802, and it is quite fitting that one hundred years of successful business should be so commemorated. The company was started as Abel Porter & Co. In 1811 the name was changed to Leavenworth, Hayden & Scovill. In 1827 the business became a partnership, known as J. M. L. & Wm. H. Scovill. In 1850 the Scovill Manufacturing Company was incorporated.

The medal represents that clean-cut and finished appearance characteristic of the finest grade of the die-sinker's art, and was made by the company itself. The medal is indicative of the fine grade of work done by the Scovill company in this direction. The obverse side of the medal has the name of the company and busts of the two Scovill brothers. The reverse side gives the chronology of

the company and an innovation in the shape of the name of each recipient. This name was stamped on the medal by means of letters inserted in the die and is the first instance which has ever been brought to our notice of such a practice being followed in the striking of a medal. The medal was presented in a handsome leather case, lined with blue silk and plush. We herewith show the obverse and reverse sides of the medal as it rests in the case.

CORRESPONDENCE DEPARTMENT

In this department we will answer the inquiries of readers who have shop and foundry problems in the working and casting of aluminum, brass and copper, their allied metals and alloys. Address all communications to THE METAL INDUSTRY, 61 Beekman Street, New York.

Q.—A brass founder asks us for a good mixture for making trolley clips and wheels. The composition must be red and machine well.

A.—The usual mixture for this work consists of copper, 1 lb.; tin, lead and zinc, each 1 oz. This gives a mixture of the following percentages, viz: Copper, 84.25 per cent.; tin, 5.25 per cent.; lead, 5.25 per cent.; zinc, 5.25 per cent. An analysis of a trolley clip taken at random from stock gave the following results, viz: Copper, 84.13 per cent.; tin, 7.28 per cent.; lead, 5.06 per cent.; zinc, 3.37 per cent. In the latter the tin is higher than is necessary and the cost is somewhat increased thereby.

Q.—A correspondent asks the proper flux to use in retinning sheet and wire goods.

A.—A grease or oil of some kind is what is generally used. If oil is used it should be of such a nature that it will not burn off at the temperature of the melted tin. Palm oil answers well, but we find many manufacturers who tin malleable iron castings are now using cottonseed oil.

Q.—Information is desired about the uses of sulphate of copper, what material it is made from and whether the demand for it is constant.

A.—Sulphate of copper (blue vitriol) is used for the manufacture of colored paints. The green and blue pigments all contain copper and blue vitriol is used for the manufacture of the coloring matter. This is by far the largest used, and while a small amount is used in dyeing and in batteries the consumption in this line is, compared with that of paints, quite small. The sulphate of copper now produced is nearly all a by product in the manufacture of silver. Copper plates are used to precipitate the silver in solution. The silver precipitates in the metallic state and the copper is dissolved and is crystallized out as the blue vitriol.

Q.—A brass manufacturer desires information in regard to the waste in melting brass.

A.—The waste in melting brass is a difficult matter to give accurate information upon on account of the various factors which are variable. It depends upon the kind of metal that is used, whether scrap or new metal, what size pots are used and how long the metal remains in the fire. In sand casting shops the waste is very much greater than in the rolling mills, as in the latter the work is more uniform. The following is supposed to represent the best possible practice in the way of shrinkage in melting:

Composition ingot or new metal....	0.75	to 1.25	per cent.
Yellow brass ingot or new metal...	1.5	to 2	per cent.
Composition scrap (light).........	1.5	to 2.5	per cent.
Yellow brass scrap (light).........	2	to 4	per cent.
Composition chips	3	to 6	per cent.
Yellow brass chips................	5	to 10	per cent.

The more spelter there is in metal the greater the loss.

A foundryman writes: "I was much interested in an answer in the Correspondence Department of your January number, describing and illustrating a skim gate. I used this in my foundry work fifteen years ago with the greatest success. Any one who has not seen it used can hardly appreciate its worth in producing sound castings."

THE BRASS AND COPPER TRADE IN ENGLAND

The *Iron Age* correspondent, writing from London on January 10, 1903, makes the following comments upon the condition of the brass and copper trade in England during the year 1902. He says:

"In the brass and copper trades great disorganization was created by the uncertainty of the copper market. In 1901 the year's profits were marred by the sudden collapse in the price of copper, leading, as I remember writing in the *Iron Age,* to adverse financial reports by the local brass and copper founders who had to value stock at prices which completely wiped out profits. It will be remembered that copper fell in a few months from £70 to less than £50 per ton. Since then there has been no permanent rally; indeed, the price of copper at the beginning and the end of the year shows no great fluctuation. But buyers have been nervous, and this had an unsettling effect. On over seas account there has been a distinct improvement in the wrought copper trade, notably to Turkey and India. The decline in engineering and shipbuilding trades necessarily affected the demand for seamless brass and copper tubes, but the increasing demand for copper for electrical purposes had a good effect on the copper tap and wire branches, and to some extent on the strip trade also. The cabinet and general brass foundry trades have been dull, the only exceptions being the makers of brass cocks, taps, unions and hydrants. The demand for high-class table lamps fell off seriously, but cheap oil lamps sold well, and throughout the year there was a well sustained demand for gas fittings, chiefly brackets, notwithstanding the spread of electric lighting. Fair employment was obtained in the brass fender and hearth furniture trades, and there was some recovery in the brass and composite bedsteads, side by side with the revival in wooden bedsteads."

Walter Camp, Yale's athletic director, was recently elected president of the New Haven Clock Company.

Four of the six brass molders on trial at Chicago for conspiracy to injure non-union workmen during the Western Electric Company's labor troubles in 1902 have been found guilty. Two of the men were sentenced to pay a fine of $1,250 and two were fined $750 each.

Mr. S. E. Winslow, who has been foreman for twenty years of the brass foundry of the Hancock Inspirator Company, Boston, Mass., has resigned that position to become foreman for the Nathan Manufacturing Company, of New York. Robert Newell has been appointed to Mr. Winslow's former position.

On February 13, at the Supreme Court, New Haven, Conn., Morris B. Beardsley, of Bridgeport, was appointed receiver for the Matthews & Willard Manufacturing Company, of Waterbury, Conn. The debts of the company are stated to be $272,780, and assets valued at $411,604. The Scovill Manufacturing Company, of Waterbury, Conn., are the largest creditors, with a claim of $150,000.

The Bridgeport Metallic Packing Company has been incorporated at Bridgeport, Conn., for the manufacture of Ensign's California metal packing and similar metallic goods. The company has been organized with a capital stock of $30,000. The officers are: President, Louis S. Morris; Vice-President W. R. Bassick; Secretary and Treasurer, F. C. Bassick.

ALUMINUM UTENSILS IN ENGLAND.

Bowen & Co., of London, England, manufacturers of pure aluminum cooking utensils, send us the following letter which we believe will interest all manufacturers of aluminum cooking utensils throughout the world:

"It may interest your readers to learn that aluminum cooking utensils, after a long period of probation and struggle against vested interests, are beginning to be adopted by some large users in England. We find that it is almost impossible to discover a chef in London who is disposed to give aluminum a trial, or, if compelled to try it by superior orders, ever gives it a fair trial. His interests and a considerable part of his income lie on the side of copper utensils, which journey to and fro all the year long to the coppersmiths to be re-tinned, and each pilgrimage is not forgotten at Xmas, when chefs are always glad to see you or hear from you. With his kitchen full of aluminum utensils Xmas would be a season of gloom and emptiness, as they never leave until after a long life of usefulness.

"Now, these conditions do not hold good at sea, where the cook never sees the coppersmith, and has no interest in him. The result is aluminum is being adopted by some of the leading steamship companies, who, after trying it for years, have proved its superiority over copper, and determined to adopt it. The ordinary utensil, spun or stamped, or hammered out of a sheet of aluminum, is, however, no use on board a steamship. After a trip to China and back it would be sadly punished and out of shape, besides being out of use and the cook out of temper. Aluminum cooking utensils for use at sea must be made extra strong and designed so as to give the necessary strength where it is required. We early directed our attention to the production of such utensils, which we found could only be made from castings in which we could make the walls and bottoms of the required strengths and thickness. Our patience has been rewarded and our aluminum utensils are now afloat in the galleys of some of the premier steamship companies of the world. At the present moment we are making complete outfits for four new vessels being built for the Peninsular and Oriental Company, two on the Clyde and two at Belfast, which will make the seventh vessel in that company's fleet equipped with our utensils. We trust the big hotels on land may learn from the big hotels at sea and insist in using the metal which nature seems to have earmarked as the one to cook our food in."

Dr. Peter T. Austen, 80 Broadway, New York, is counsel and expert in manufacturing chemistry and in patent and technical litigation.

The S. Obermayer Company, Cincinnati, Chicago and Pittsburg, have in stock at their warehouses in these cities everything needed by the foundryman.

The Pioneer Brass Works, Indianapolis, Ind., report a larger business for 1902 than 1901. They have just completed the second year in their new plant.

The Bridgeport Gun Implement Company, of 315 Broadway, New York, are putting on the market several new styles of the Mills aluminum golf clubs, which were shown in The Aluminum World of July, 1902.

The Bridgeport Chain Company, Bridgeport, Conn., announce that they manufacture the only strong aluminum chain. Also they make chains in other metals, and state that their steel chain with their patent link shows twice the strength of welded iron. The company manufacture ten miles of chain per day.

TRADE NEWS

The Gautier crucibles have been manufactured for forty-five years by J. H. Gautier & Co., Jersey City, N. J.

Another story is being added to the brass foundry of Landers, Frary & Clark, New Britain, Conn., manufacturers of brass goods.

The Dings Electro-Magnetic Separator Company, of Milwaukee, Wis., manufacture separators for all purposes, standard or special designs.

The chief product of the Ajax Metal Company, Philadelphia, Pa., is "Ajax Plastic Bronze," a bearing metal that is extensively used by railroads.

The Canada Corundum Company, Toronto, Canada, have started work on a new mill which will have a capacity several times the size of their present plant.

The Syracuse Smelting Work, 94 Gold street, New York, are putting on the market "Syracuse Phosphor Tin." A free sample is furnished to brass founders.

The Baltimore Copper Smelting and Rolling Company, of Baltimore, Md., have received an order for copper fire box sheets for the Kuishi Railway Company, of Japan.

The Beaver Valley Metal Company, of New Brighton, Pa., were recently incorporated and will make a specialty of phosphor bronze, phosphor copper and brass castings.

The increase in their business of dry barrel polishing metals and leathers has brought to the consideration of the Peckham Manufacturing Company, of Newark, N. J., the erection of an addition to their present plant.

The International Silver Company have resumed operations at their factory in Lyons, N. Y., formerly the Manhattan Silver Plate Company. Albert F. Sheldon has been appointed superintendent.

The Hecla Iron Works, of Brooklyn, have published a series of engravings showing their ornamental work in iron and bronze gates, railings, fences, newel posts, lamp-posts, lamp brackets and urns.

The National Corundum Wheel Company, Clayville, N. Y., have bought the foundry and machine shop of A. E. King & Co., which they will equip with machinery for the manufacture of corundum and emery wheels.

The Goodwin and Kintz Company, Winsted, Conn., make a specialty of spinning all kinds of metals, as well as general metal work, and have recently received orders from automobile and motor cycle manufacturers for brass and special sheet metal parts.

It is announced that a syndicate of capitalists from Wilkes-Barre, Pa., have absorbed the graphite interests of Canada and a new company known as the Greenville Graphite Company, will develop the Canadian property consisting of 500 acres, situated in Greenville, midway between Montreal and Quebec.

Application is to be made to the lieutenant governor of New Brunswick for a charter of incorporation of the Aluminum Production Company. The object for which the company seeks incorporation is to manufacture alumina and aluminum goods.

Joseph Koenig, manager of The Aluminum Manufacturing Company, of Two Rivers, Wis., made a visit to New York during the past month. Rumor had it that the company was to open a New York store, but the company advise us that this is not true.

The latest style of the Manitowoc cigar case is made in satin finish and engraved, also black enameled and engraved, and is one of the best sellers of the Manitowoc Aluminum Novelty Company, Manitowoc, Wis.

One of the latest novelties of The E. A. Fargo Company, Attleboro, Mass., is a silver aluminum key-tag and ring. The ring is made of steel silver-plated to match the color of the aluminum tag. The tag is made of heavy stock, and the end of it is beveled so that it can be used as a watch case opener.

The New Jersey Aluminum Company is making some novel aluminum signs. They are so highly polished that they have a glass effect and have a colored background. Other new goods are butterfly calendars, which have the "glass" polish and a decorated metal butterfly attached to the calendar plate. The New Jersey Aluminum Company takes pride in producing goods of original design.

Alex. Cowan & Sons, Melbourne, Australia, are in the market for aluminum novelties and desire the catalogues of aluminum manufacturers and their best terms to dealers. They would also like to know of the latest novelties as they are put on the market. Alex. Cowan & Sons' are known in the United States as they have large dealings with prominent American firms.

A neat catalogue has been issued by The Fletcher Aluminum Company, of Springfield, Mass., showing novelties manufactured by that company, which include various souvenir boxes, confectionry boxes, advertising and souvenir trays, book-marks, letter openers, cards, hanging panels, guide boards, letters and figures. The guide boards are of wood coated with powdered aluminum.

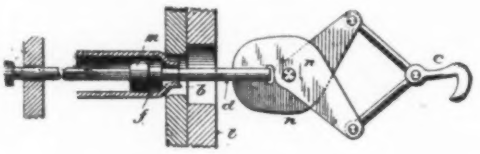
Another aluminum solder has been put on the market by Geo. Callahan & Co., 218 Front street, New York. The firm state that their solder has been subjected to severe tests, lasting for months, and that it makes a lasting joint. The solder requires no flux or liquid of any kind and is applied with a common soldering bolt. It is believed that the solder will work well for repairing aluminum cooking utensils.

The Ansonia Novelty Company, Ansonia, Conn., who make a specialty of cast shears and steel and aluminum thimbles both for the trade and advertising purposs, have recently perfected a thimble with a thread cutting device which seems very practicable, and should be a good seller, not only as a novelty but as a staple article. This concern also make an exceptionally durable aluminum thimble which is superior to the ordinary imported thimble sold to the trade.

PATENTS

A full copy of any Patent mentioned will be furnished for Ten Cents
Address THE METAL INDUSTRY, 61 Beekman Street, New York

718,671, Jan. 20, 1903. TUBE-DRAWING DEVICE.—Ralph S. Stiefel and Richard T. Brown, Ellwood City, Pa., assignors to Standard Seamless Tube Company, a

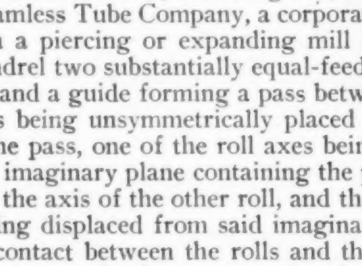


corporation of Pennsylvania. In combination with a die and as a means for drawing a tube, a mandrel, a mandrel-bar therefor, means for holding the mandrel-bar, a draw-link adapted to be inserted in the tube and provided with a shoulder for engaging the reduced end of the tube when in place, the engaging edge of said shoulder being substantially sharp for internally biting and holding the reduced end of a tube, said draw-link having a shank of length to project from the tube to be drawn, and means for gripping and giving motion to the said shank to draw the tube through the die.

717,833, Jan. 6, 1903. COMPOSITION FOR MAKING SOLDERING STICKS.—Owen J. Flanigan, Boston, Mass. The composition of matter consisting of spermaceti three-fourths of a pound, mutton tallow one-fourth of a pound, and acetic acid three-fourths of an ounce.

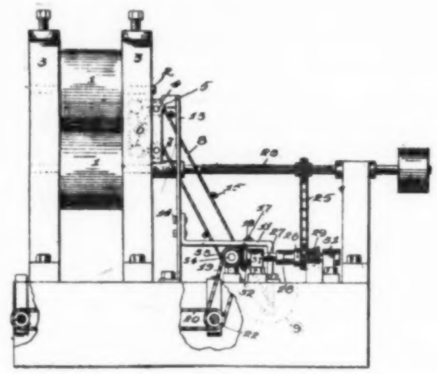
718,546, Jan. 13, 1903. MANUFACTURE OF METAL RODS OR THE LIKE.—Frederick Tomlinson, Salford, England, assignor of one-half to the Broughton Copper Company (Limited), Salford, England. The method of making metal rods and the like, which consists in forming holes in a metal ingot and then reducing the ingot in diameter until the holes become elongated and closed and thus divide the intermediate portion of the rod thus formed into strands connecting undivided portions of the metal.

718,723, Jan. 20, 1903. PIERCING AND EXPANDING



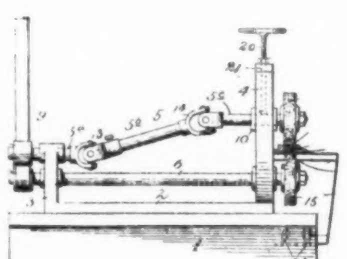
MILL.—John H. Nicholson, Pittsburg Pa., assignor to the Standard Seamless Tube Company, a corporation of Pennsylvania. In a piercing or expanding mill the combination of a mandrel two substantially equal-feeding obliquely rolling rolls, and a guide forming a pass between the rolls, the said rolls being unsymmetrically placed in respect to the axis of the pass, one of the roll axes being inclined in respect to an imaginary plane containing the pass axis and parallel with the axis of the other roll, and the axis of said other roll being displaced from said imaginary plane, and the lines of contact between the rolls and the billet being unsymmetrical instead of opposite, whereby the billet is pressed toward the guide.

718,471. Jan. 13, 1903. MEANS FOR GREASING THE NECKS OR JOURNALS OF ROLLING-MILL ROLLS—Reese R. Jones and Thomas W. Jones, St. Louis Mo. The combination with rolling-mill rolls having the usual necks or journals, of a chain arranged to travel in a line parallel with the axis of the said necks, suitable rollers and wheels for supporting said chain in close proximity to said necks, absorbent swabs carried by said chain, a source of grease



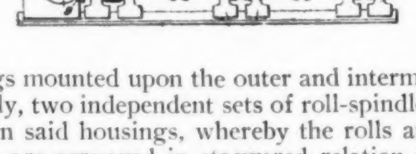
to which said chain extends, means for imparting motion to the said chain, a wiper for removing excess of grease from said swabs after they leave said source of grease, and means for starting and stopping said chain while the movement of said rolls continues, substantially as specified.

718,549. Jan. 13, 1903. MACHINE FOR CLEANING AND POLISHING THE OUTER SURFACES OF RODS, TUBES, OR PIPES.—Thomas B. Van Auken, Lyons, N. Y. In a de-



vice for cleaning and polishing rods and tubes, the combination, of a transversely-adjustable table having a guide-groove therein for rods, a brush mounted on one side of said table, a jointed shaft mounted to be adjusted transversely and bearing a brush, and means for driving said brushes, substantially as described.

718,476. Jan. 13, 1903. MILL FOR ROLLING SEAMLESS TUBING.—John H. King and Edward M. Wolfe, Beaverfalls, Pa., assignors of one-third to George H. Blaxter, Pittsburg, Pa. In a rolling-mill, the combination with outer housing-supporting foundation-rails and an intermediate housing-supporting rail; two independent sets



of housings mounted upon the outer and intermediate rails respectively, two independent sets of roll-spindles and rolls mounted in said housings, whereby the rolls and spindles of one set are arranged in staggered relation to the rolls and spindles of the other set, a driving element, and gearing connecting said driving element with the spindle of each set respectively, substantially as set forth.

Metal Prices, March 7, 1903

METALS.

	Price per lb.
TIN—Duty Free.	
Straits of Malaca	30.45
COPPER, PIG, BAR AND INGOT AND OLD COPPER—Duty Free. Manufactured 2½c. per lb.	
Lake	14.00
Electrolytic	13.90
Casting	13.80
SPELTER—Duty 1c. per lb.	
Western	5.15
LEAD—Duty Pigs, Bars and Old 2⅛c. per lb.; pipe and sheets 2½c. per lb.	
Pig Lead	4.15
ALUMINUM—Duty Crude, 8c. per lb. Plates, sheets, bars and rods 13c. per lb.	
Small lots	.37
100 lb. lots	.35
1,000 lb. lots	.34
Ton lots	.33
ANTIMONY—Duty ¾c. per lb.	
Cooksons	8.50
Hallets	7.25
Other	6.75
NICKEL—Duty 6c.. per lb.	
Large lots	40 to 50
Small lots	50 to 60
BISMUTH—Duty Free	$1.50 to $2.00
PHOSPHORUS—Duty 18c. per lb.	
Large lots	45
Small lots	65 to 75
	Price per oz.
SILVER—Duty Free—Commercial Bars	$0.48½
PLATINUM—Duty Free	19.00
GOLD—Duty Free	20.00
QUICKSILVER—Duty 7c. per lb. Price per Flask	48.00

PRICE FOR ALUMINUM BRONZE INGOTS.

	Per pound.
2½ per cent	19c.
5 per cent	19½c.
7½ per cent	20½c.
10 per cent	21½c.

Above prices are for lots of not less than 500 pounds.

Manganese Bronze, Ingots	16½c.
Phosphor Bronze, Ingots	15 to 18c.
Silicon-Copper, Ingots	34 to 36c.

OLD METALS.

	Buying.	Selling.
Heavy Cut Copper	11.50c.	12.25c.
Copper Wire	11.25c.	12.00c.
Light Copper	10.25c.	11.00c.
Heavy Mach. Comp	11.25c.	12.00c.
Heavy Brass	8.25c.	9.00c.
Light Brass	6.50c.	7.00c.
No. 1 Yellow Brass Turnings	7.50c.	8.00c.
No. 1 Comp. Turnings	10.50c.	11.00c.
Heavy Lead	3.90c.	4.00c.
Zinc Scrap	3.65c.	3.80c.
Scrap Aluminum, sheet, pure	22.00c.	25.00c.
Scrap Aluminum, cast, alloyed	16.00c.	20.00c.

PRICE LIST FOR SHEET COPPER.

Prices in Cents per Pound, Net.

Not wider than	Not longer than	And longer than	64 oz. & over, 50 lb. sheet, 30 x 60 and heavier	32 oz. to 64 oz. 25 to 50 lb.	24 oz. to 32 oz. 18¾ to 25 lb.	16 oz. to 24 oz. 12½ to 18¾ lb.	14 oz. and 15 oz. 11 to 12½ lb.	12 oz. and 13 oz. 9½ to 11 lb.	10 oz. and 11 oz. 7¾ to 9½ lb.	8 oz. and 9 oz. 6¼ to 7¾ lb.	Lighter than 8 oz.
Ins.	Ins.	Ins.									
30	72	....	18	18	18	18	19	20	21	24	27
30	96	72	18	18	18	18	19	21	24	27	
30	....	96	18	18	18	18	20	24			
36	72	....	18	18	18	18	20	22	25	28	
36	96	72	18	18	18	18	20	24	27		
36	120	96	18	18	18	19	21				
36	....	120	18	18	19	20					
48	72	....	18	18	19	20	22	25	28		
48	96	72	18	18	19	21	23	26			
48	120	96	18	18	20	22	26				
48	....	120	18	19	21	24					
60	72	...	18	18	19	21	24	29			
60	96	72	18	18	20	22	27				
60	120	96	18	19	21	24					
60	....	120	19	20	22	26					
72	96	....	18	19	21	26					
72	120	96	18	20	23	28					
72	....	120	19	21	26						
108	96	....	19	22	25						
108	120	96	20	21	24						
108	....	120	21	23	27						
Wider than 108	132	. ..	22	24							
Wider than 108	....	132	23	26							

Rolled Round Copper, ⅜ inch diameter or over, 18 cents per pound. (Cold Drawn, Square and Special Shapes, extra.)

Circles, Segments and Pattern Sheets three (3) cents per pound advance over prices of Sheet Copper required to cut them from.

All Cold or Hard Rolled Copper, 14 ounces per square foot and heavier, one (1) cent per pound over the foregoing prices.

All Cold or Hard Rolled Copper, lighter than 14 ounces per square foot, two (2) cents per pound over the foregoing prices.

Cold Rolled and Annealed Copper, Sheets and Circles, wider than 17 inches, take the same price as Cold or Hard Rolled Copper of corresponding dimensions and thickness.

All Polished Copper, 20 inches wide and under, one (1) cent per pound advance over the price for Cold Rolled Copper.

All Polished Copper, over 20 inches wide, two (2) cents per pound advance over the price for Cold Rolled Copper.

Planished Copper, one (1) cent per pound more than Polished Copper.

Cold Rolled Copper prepared suitable for polishing, same prices and extras as Polished Copper.

Tinning.

Tinning Sheets, on one side, all sizes, per square foot, 2¼ cents.

For Tinning Sheets, both sides, double the above price.

For tinning circles and segments, price is 2¼ cents per square foot upon the square of the circle, *i.e.* a 12 inch circle is considered one square foot.

For tinning the edges of sheets one or both sides, price shall be the same as for tinning all of one side of the specified sheet.

PRICE LIST FOR ROLL AND SHEET BRASS.

Prices are for 100 lbs. or more of sheet metal in one order.
Brown & Sharpe's Gauge the Standard.

Common High Brass	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Wider than and including	2 12	12 14	14 16	16 18	18 20	20 22	22 24	24 26	26 28	28 30
To No. 20 inclusive..	.22	.23	.25	.27	.29	.31	.33	.36	.39	.42
Nos. 21, 22, 23 and 24	.22	.24	.26	.28	.30	.32	.34	.37	.40	.43
Nos. 25 and 26........	.23	.24⅛	.27	.29	.31	.33	.35	.38	.41	.44
Nos. 27 and 28........	.23	.25	.28	.30	.32	.34	.36	.39	.42	.45

Add ½ cent per lb. additional for each number thinner than Nos. 28 to 38, inclusive.

Add 7 cents per lb. for sheets cut to particular lengths, not sawed, of proportionate width.

Add for polishing on one side, 40 cents per square foot; on both sides, double this price.

Brazing, Spinning and Spring Brass, 1 cent more than Common High Brass.

Extra Quality Brazing, Spinning and Spring Brass, 2 cents more than Common High Brass.

Low Brass, 4 cents per lb. more than Common High Brass.

Gilding, Rich Gold Medal and Bronze, 7 cents per lb. more than Common High Brass.

Discount from List, 35 per cent.

Sheet Lead, 7¼c. per lb., 20% off.

Lead Pipe, 6½c. per lb., 20% off.

Zinc—Duty, Sheet, 2c. per lb., 600 lb. casks, 6.60c. per lb.

Metal Prices, March 7, 1903

PRICE LIST FOR BRASS AND COPPER WIRE.

BROWN & SHARPE'S GAUGE THE STANDARD.	Com. High Brass	Low Brass	Gilding Bronze and Copper
All Nos. to No. 10, Inc	$0.23	$0.27	$0.31
Above No. 10 to No. 16	.23⅛	.27⅛	.31⅛
Nos, 17 and 18	.24	.28	.32
" 19 and 20	.25	.29	.33
No. 21	.26	.30	.34
" 22	.27	.31	.35
" 23	.28	.32	.36
" 24	.30	.34	.38

Discount, Brass Wire, 35 per cent.; Copper Wire, net.

ALUMINUM.

Drawn Rod and Wire Price List.—B. & S. Gauge.

Diameter B.& S.G'ge.	0000 to No.10	No. 11.	No. 12.	No. 13.	No. 14.	No. 15.	No. 16.	No. 17.	No. 18.	No. 19.	No. 20.	No. 21.	No. 22.
Price per lb	$ 38	38½	38½	0 39	39½	0 40	40½	0 41	0 42	0 43	0 44	0 47	0 52

200 lbs. to 30,000 lbs., three cents off list.
30,000 lbs. and over, four cents off list.

Price Per Foot of Seamless Aluminum Tubing.

(CHARGES MADE FOR BOXING.)

THICKNESS OF WALL IN STUBS' GAUGE.

Outside Diameter in Inches.	No. 12.	No. 14.	No. 16.	No. 18.	No. 20.	No. 22.	No. 24.		Outside Diameter in Inches.
1-4	......	......	......	10	9	8	7		1-4
5-16	......	......	......	11	9	8	7		5-16
3-8	......	......	......	12	9	8	7		3-8
1-2	......	......	17	14	11	9	8		1-2
5-8	......	......	21	16	13	12	......		5-8
3-4	......	......	25	19	16	14	......		3-4
7-8	......	......	28	22	18	16	......		7-8
1	......	......	30	25	21	19	......		1 00
1 1-4	......	......	36	30	25	......	......		1 1-4
1 1-2	......	52	43	35	28	......	......		1 1-2
1 3-4	......	60	50	41	33	......	......		1 3-4
2	84	68	58	47	37	......	......		2 00

Orders of 100 to 500 feet 20 per cent. discount.
Orders of 500 feet or over 30 per cent. discount.
Cutting to exact length 15 per cent. additional.

Sawed bars in widths less than 2 inches, an additional charge of 6 cents over the cost of sheet Aluminum; in widths of 2 inches and over, additional charge of 3 cents over the price of sheet Aluminum.

PRICE LIST FOR SHEET ALUMINUM.

PLATE AND SHEET PRICE LIST.—B. & S. GAUGE.

Prices are for 50 pounds or more at a time. Less quantities, 5 cents per pound additional. Charges made for boxing.

Wider Than... And Including...	*3 in. 12 in. in coils.	6 in. 14 in.	14 in. 16 in.	16 in. 18 in.	18 in. 20 in.	20 in. 24 in.	24 in. 30 in.	30 in. 36 in.	36 in. 40 in.	40 in. 45 in.	45 in. 50 in.	50 in. 55 in.	55 in. 60 in.	Polishing One Side.	Sat. Fin. without Lacquer. One Side.
No. 13 & heavier	......	42	44	44	44	44	47	47	47	48	48	49	50	2	6
" 14	......	42	44	44	44	44	47	47	47	48	48	49	50	2	6
" 15	......	42	44	44	44	44	47	47	47	48	48	49	50	2	7
" 16	......	42	44	44	44	44	47	47	47	48	48	49	50	2	8
" 17	......	42	44	44	44	44	47	47	47	48	48	49	50	3	9
" 18	......	42	41	44	44	44	47	47	50	51	51	54	57	3	10
" 19	......	42	44	44	44	44	47	48	51	52	52	56	59	4	11
" 20	42	44	44	44	44	46	49	50	52	53	53	58	61	4	12
" 21	42	46	46	46	46	48	51	52	58	59	62	65	......	5	14
" 22	42	46	46	46	48	48	51	55	59	61	64	......	......	5	16
" 23	42	46	46	46	48	48	51	57	60	64	......	......	......	6	18
" 24	42	46	48	50	50	50	53	59	62	......	......	......	......	6	20
" 25	44	47	49	51	51	51	54	61	......	......	......	......	......	7	23
" 26	44	47	50	54	54	54	59	......	......	......	......	......	......	8	25
" 27	44	48	52	56	56	57	62	......	......	......	......	......	......	10	28
" 28	44	48	54	56	57	57	64	......	......	......	......	......	......	11	32
" 29	46	49	56	58	60	60	69	......	......	......	......	......	......	13	36
" 30	46	50	58	60	64	70	77	......	......	......	......	......	......	15	40
" 31	48	52	60	63	68	76	......	......	......	......	......	......	......	17	44
" 32	50	54	62	66	74	82	......	......	......	......	......	......	......	19	50
" 33	52	56	......	......	......	......	......	......	......	......	......	......	......	21	57
" 34	55	60	......	......	......	......	......	......	......	......	......	......	......	25	66
" 35 & 36	1 67	Not wider than 6 in.	......	......	......	......	......	......	......	......	......	......	......	Polished two sides double above prices.	Satin Finish two sides double above prices.
" 37 & 38	1 98		......	......	......	......	......	......	......	......	......	......	......		
" 39 & 40	2 22		......	......	......	......	......	......	......	......	......	......	......		
".003" to .0015"	2 42		......	......	......	......	......	......	......	......	......	......	......		
Less than .0015"	2 66		......	......	......	......	......	......	......	......	......	......	......		

Additional charge for slitting coiled sheet in widths less than 3 in. and flat rolled sheets in widths less than 6 in.
All columns except the first are for Flat Rolled Sheets.

Discounts as follows are given for sheet orders over 200 pounds.

200 to 1,000 pounds		10 per cent. off list.
1,000 to 2 000 "	10 per cent. and 2 "	"
2,000 to 4,000 "	10 " " 3 "	"
4,000 pounds and over	10 " " 5 "	"

Sheets polished or satin-finished on both sides, double the price for one side.

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list.

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Additional charge for slitting coiled sheet in widths less than 3 in. and flat rolled sheets in widths less than 6 in.
All columns except the first are for Flat Rolled Sheets.